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Theo A. F. Kuipers

**THE INSTRUMENTALIST ABDUCTION TASK AND THE NATURE
OF EMPIRICAL COUNTEREXAMPLES**

REPLY TO ATOCHA ALISEDA

After the 1998 Ghent conference on scientific discovery and creativity, organized by Joke Meheus and Thomas Nickles, Atocha Aliseda was the first to take up my challenge (published in 1999) for computational modeling of instrumentalist abduction, with Joke Meheus following, witness the next paper. I greatly appreciate the clear and convincing way in which Aliseda shows that her general semantic tableau method for abduction can be used to make empirical progress of a special kind: the identification and subsequent resolution of lacunae. An especially nice feature of her method is that it does not favor revisions by adding initial conditions, but also generates proper theory revisions, as her leading example in Section 3 (from H1 to H3) essentially illustrates by adding a conditional statement.

To be honest, I do not rule out that Patrick Maher will be able to find some holes in this paper, in particular in Section 3.2 with the crucial transition from Aliseda's first explication of my rather intuitive notion of lacuna, lacuna*, to her second explication, lacuna**, a transition in which reference to the available initial conditions is removed. However, I am also fairly sure that such problems can either be solved by some further refinement or that they are typically artificial in nature, such that it is difficult, if not impossible, to imagine real-life instantiations of them.

In the rest of this reply I first deal with the remaining task of instrumentalist abduction, in particular the general task of theory revision in the face of remaining counterexamples. For this purpose it seems important to explicate the nature of empirical counterexamples, in particular by comparing them with logical counterexamples, which is my second aim.

Toward the General Instrumentalist Abduction Task

As Aliseda explains in Note 6, her paper is restricted to the first special task of abduction that I discerned in my 1999-paper, viz. "novelty guided abduction."

In: R. Festa, A. Aliseda and J. Peijnenburg (eds.), *Confirmation, Empirical Progress, and Truth Approximation (Poznań Studies in the Philosophy of the Sciences and the Humanities, vol. 83)*, pp. 190-192. Amsterdam/New York, NY: Rodopi, 2005.

A novelty, that is, a lacuna in the face of the available theory(-cum-initial-conditions) and background knowledge, is transformed into a success of a revised theory. As her paper and Aliseda (1997) make clear, she would be able to deal in a similar way with the other special task, “anomaly guided abduction,” that is, transforming a counterexample of a theory (together with the background knowledge), into a success, or at least a lacuna, of a revised theory. However, in the first case it is assumed that the total available evidence reports no counterexample and, in the second case, there is at most one, the target counterexample. However, general instrumentalist abduction will also have to operate in the face of the concession that other counterexamples have to remain in the game, at least for the time being. It is not yet entirely clear to me that this can be done, nor how, with Aliseda’s adapted tableau method. This is not to say that I think that it is impossible; I just have no clear view on whether it can be done in a similar way. One reason is that the method will now have to deal with the problem of which evidence is taken into account and which evidence is set aside. Another reason is that, from a tableau perspective, whether of some standard kind or of Aliseda’s abductive kind, the notion of counterexamples and logical entailment are intimately related, but it is not at all clear what such (logical) counterexamples have to do with empirical counterexamples, as they occur in the empirical sciences. This is an interesting question independent of whether one assigns dramatic consequences to empirical counterexamples, as Popper is usually supposed to do, or the more modest role they play in my “comparative evaluation matrix” and subsequent theory of truth approximation. Incidentally, the latter theory is abductively related to the matrix (Kuipers 2004).

Logical and Empirical Counterexamples

For the moment I would like to confine myself to the major similarities and differences between logical and empirical counterexamples, and their relation. As is well-known, the standard form of a logical counterexample pertains to an argument with a (set of) premise(s) P and a purported conclusion C . It is a model of P , that is, a relevant structure on which P is true, which is a countermodel of C , that is, a structure on which C is false. Such a type of counterexamples is typically sought by the standard tableau methods. Of course, one may also say that such a model is a countermodel to “If P then C ” as a purported logical truth.

An empirical counterexample typically is a counterexample *of a certain empirical theory*, say X . The explication of this is less standard. Certainly, an empirical counterexample of X is a countermodel of X and hence a logical

counterexample of X when X is taken as a purported logical truth. However, nobody will normally claim this for an empirical theory. Hence we will have to look more closely at what an empirical theory is or claims. In my favorite “nomic structuralistic approach” (see the Synopsis of ICR), theorizing is trying to grasp the unknown “set of nomic possibilities” that is, uniquely determined, according to the Nomic Postulate, given a domain of reality and a vocabulary. This set may well be called “the (nomic) truth” (see below), indicated by T . Assuming that the vocabulary is a first order language in which (X and) T can be characterized, an empirical counterexample of X must represent a “realized (nomic) possibility,” that is, a piece of existing or experimentally realized reality, for realizing an empirical *impossibility* is of course by definition impossible, assuming that no representation mistakes have been made. Hence, an empirical counterexample of a theory X is not only a countermodel of X but also a model of T , and therefore it is a logical counterexample to the claim that T logically entails X , and hence to the claim that “if T then X ” is a logical truth. The latter I call the (weak¹) claim of a theory X : all models of T are models of X or, equivalently, X is true for all nomic possibilities. I call a X true when its claim is true. In this sense, (the statement) T is the (logically) strongest true statement. For this reason, T is called “the truth.” In sum, from the nomic structuralist perspective there is a clear relation between empirical and logical counterexamples: an empirical counterexample of a theory X is also a special type of logical counterexample, viz. to the claim that T logically entails X .

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¹ The strong claim is that X and T are equivalent.